Relative Abundance and Habitat Associations of Small Mammals and Herpetofauna in Two Forest Types of Southern Oregon

PERSONNEL

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INTRODUCTION

Small mammals and herpetofauna play an important role in ecosystems. Despite their size, small mammals outweigh the entire large mammal fauna many times in terms of overall biomass (Verts and Carraway 1998). Small mammals contribute to ecological function on multiple levels including consumption of seeds, fungi, insects, and grass, and convert these materials to flesh that serve, in turn, as prey for carnivorous mammals and raptorial birds (Verts and Carraway 1998). Herpetofauna also contribute significantly to the food chain as measured by density and biomass (Bury and Corn 1991). Hairston (1987) estimated that salamanders represent 2.3 kilograms of predator biomass per hectare of forest in the Appalachian Mountains, nearly equivalent to the combined biomass of birds and small mammals. Information regarding species richness, abundance, habitat preference, and influences of land uses on these animals contributes to general ecological understanding and allows biologists and resource managers to assess ecological trends.

Previous studies have characterized small mammal and herpetofauna populations in riparian and upslope habitats in the Oregon Coast Range (McComb et al 1991; 1993, Gomez and Anthony 1996; 1998) and Cascade Mountains (Anthony et al 1987, Doyle 1990). These studies have analyzed habitat preferences, trap designs, and the response of small mammals and herpetofauna to resource management. Studies of this magnitude and type are non-existent for the mixed-conifer and oak/shrub forest types found in the southern Oregon Cascades or Siskiyou Mountains where the geographic range of small mammal and herpetofauna from distinct regions overlap.

The differences in composition and structure of vegetation because of increased water in riparian areas may influence many species of wildlife by providing food and other essential resources. Anderson et al. (1977) found that riparian vegetation in Arizona supported a diversity of mammal species not found in more open adjacent arid vegetation. Campbell and Franklin (1979) were able to identify distinct plant communities within riparian and upslope areas using a gradient approach. Plant ecologists recognize the significance of moisture gradient in structuring plant communities; however, there is a need for similar investigations on animal responses in these environments.

The distribution and abundance of small mammals and herpetofauna depends to a large degree on the vegetative characteristics of the area. The co-existence of similar small-mammal species occurs where they inhabit structurally distinct microhabitats (Rosenweig and Winakur 1969). The microhabitats available to salamanders may be limited by the composition and structure of the vegetation that affect the temperature and moisture regimes of the forest floor (Heatwole 1962; Heatwole and Lim 1961). Thus, changes in plant communities may alter small mammal and herpetofauna communities.

PURPOSE AND OBJECTIVES

The purpose of this study is to assess the effects of livestock grazing on small mammals and herpetofauna in riparian and upslope habitats and define small mammal and herpetofauna microhabitat associations in the Cascade-Siskiyou National Monument.

The specific objectives include:

1. Describe differences in species composition and relative abundance of small mammals and herpetofauna in oak/shrub and mixed-conifer forests across livestock grazing use levels.

2. Identify species with close riparian affiliation or dependency.

3. Describe specific microhabitat associations of selected species.

METHODS

Study sites will be located within the Jenny Creek watershed of the Cascade-Siskiyou National Monument (Figure 1). Eight sites will be located along a range of stream orders in mixed-conifer forests and eight more sites will be located in oak/shrub forests. Four sites of each forest type will be located in areas of historically high livestock utilization and the remaining sites will be located in areas of historically low utilization. Four replicates of each stand condition will be selected with the aid of Bureau of Land Management grazing utilization maps and field reconnaissance.

Small mammal sampling

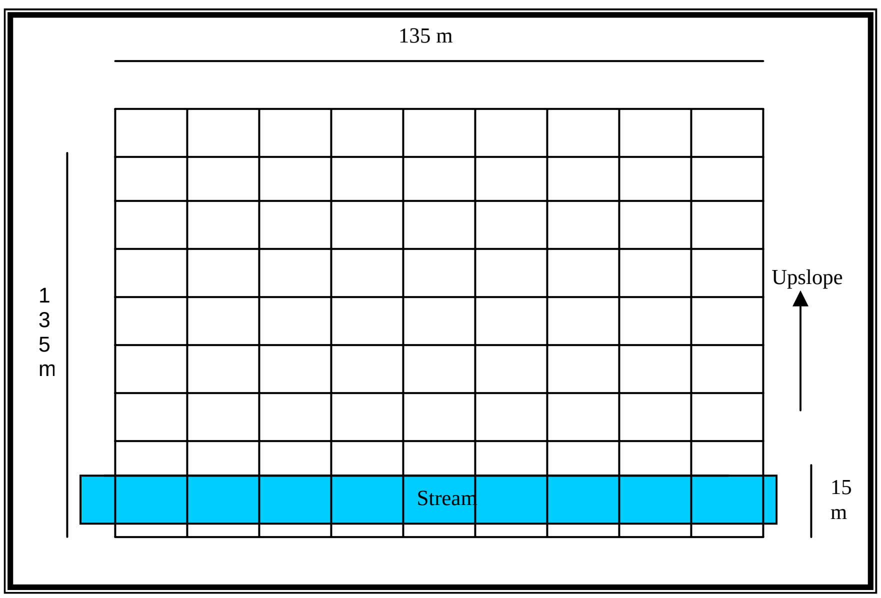
Relative abundance and species richness of small mammals will be measured for each site following methods described by Doyle (1991) and Morrison and Anthony (1988). One 10 by 10 live-trapping grid with 15-m spacings (100 trap stations) will be placed in each study site

(Figure 2). One Sherman-live trap (8 by 9 by 23 cm) will be placed within one meter of each grid coordinate and baited with peanut butter and rolled oats. Animals will be marked individually with pit tags or by toe clipping following standard mark-recapture methods in Wilson et al. (1996) and released alive at the point of capture.

Each site will be sampled for five consecutive nights and checked every morning to minimize harm to trapped animals from daytime temperatures. Sites will be sampled systematically to minimize any bias caused by chronology or weather changes. For example, the oak/shrub high and low utilization sites on Jenny Creek as well as the mixed-conifer high and low utilization sites on Keene Creek will be sampled on the same nights for five consecutive nights. The next set of sites will be sampled the following week in the same format. This design allows a paired comparison between high and low utilization sites within the same forest type. Sampling of sites will proceed when no livestock are present. Sampling will be conducted in the fall of 2003 and repeated in the fall of 2004.

Additional live-trapping grids will be placed within livestock exclosures constructed by the BLM. Size of the grid will be modified according to the size of the exclosures. Most

Figure 2: Live-trapping grid



exclosures are approximately 1/10 hectare in size and will support approximately six Sherman-live traps. Identical paired grids for each grid exclosure will be placed no less than 50 meters from the exclosure in similar habitat. Trapping methods will follow those specified above for the 16 study sites.

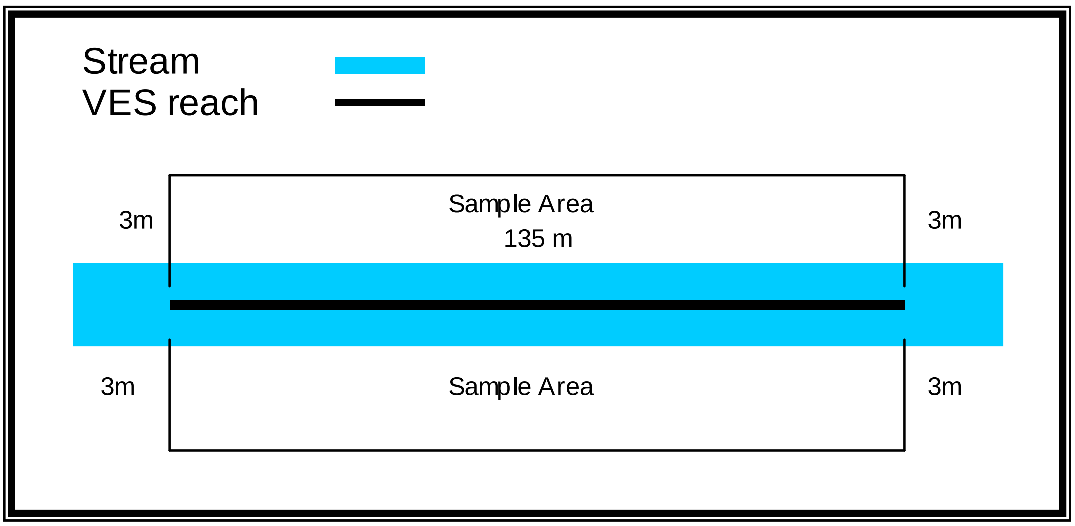
Herpetofauna Sampling

Relative abundance and species richness of herpetofauna will be measured by a combination of techniques described in Heyer et al. (1994). Visual encounter surveys (VES) implemented along streams for each site will provide a relative abundance estimate and contribute to the overall species richness. In addition to species richness and relative abundance, transect sampling will facilitate sampling herpetofauna across habitat gradients (upslope versus riparian). All animals will be captured alive, identified, and released at the point of capture.

Visual Encounter Surveys (VES)

Two surveyors will follow a 135-m reach of stream within each study site for a period of two hours counting surface animals (See Figure 3). Search intensity will follow the intermediate intensity level described in Heyer et al. (1994). Surveyors will search all microhabitat features turning over rocks, logs, surface litter, etc, to count animals within three meters of the stream.

Figure 3: VES Survey



All objects will be replaced to minimize habitat disturbance. Search time and search methods will be standardized to ensure survey consistency among sites. Time spent recording data during the search will be recorded and subtracted from the total time to ensure that two hours per person of actual search time is spent on each transect.

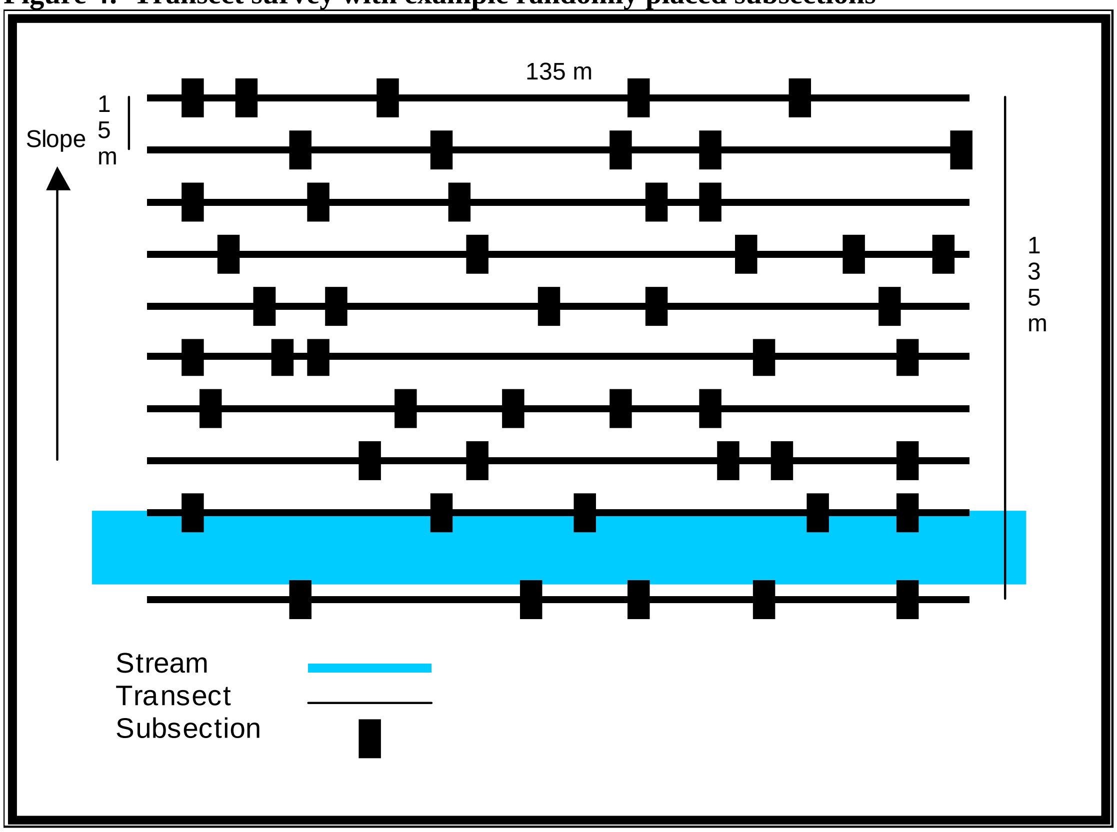
Each site will receive one VES per field season beginning early summer 2003 and in 2004. Surveys will begin at sunset each evening and continue through the night, as many target species are crepuscular and/or nocturnal (Welsh et al. 1997). Due to the logistics of the survey and limited personnel, one site per night can be surveyed. Therefore, sites will be surveyed systematically to minimize any bias caused by variations in weather. For example, the oak/shrub high utilization and low utilization sites on Jenny Creek will be surveyed on consecutive days provided weather for both surveys remains constant. Additional VES's will be considered for the fall/wet season to increase sample size, provided funding is available.

Transect Sampling

Transect sampling will follow methods for subsets of the gradient described in Heyer et al. 1994. Ten 135-m transects parallel to the stream and spaced 15 meters apart will be placed within each site. Each transect will be divided into two meter subsections two meters wide. Five subsections per transect will be selected using a random number generator (See Figure 4). For additional sampling periods, new subsections will be randomly selected excluding subsections previously sampled. Randomly selected subsections provide replicated data points for each transect revealing species and population parameters for each distance from the stream (Heyer et al. 1994).

Within each subsection, all microhabitat features are searched for ten minutes and the number of individual animals recorded. Search methods and time management is similar to those specified for VES. The order in which subsections are surveyed will be determined by a random number generator to reduce potential biases caused by weather changes during the survey. Two surveyors will search each site and subsections will be assigned to each surveyor using random number generators to eliminate inter-observer bias. Sampling will begin at sunrise (complementing evening/night surveys) for each site allowing for one site to be completed per day. Sites will be surveyed systematically as described for VES to minimize bias caused by

Figure 4: Transect survey with example randomly placed subsections



weather changes. Transect sampling will occur early summer 2003 and 2004, and fall/wet season sampling will be considered provided funding is available.

Vegetation sampling

Habitat structure and plant species composition will be measured along all transects to assess possible microhabitat associations of captured animals. Individual microhabitat characteristics at each specific capture site will be compared with species capture rates to identify any existing correlations and to assess potential responses of species to proximate cues. Potential microhabitat characteristics of importance to small mammals and herpetofauna will be measured (Table 1).

All vegetative sampling will be centered from each sampling station within a 10 m radius circular plot. Four random replicates of herbaceous ground cover will be taken using 1.0 m square quadrats within each circular plot. Litter soil depths will also be measured in the quadrat by core sampling. Many of the variables measured may influence the semi-fossorial behavior of a species and could be essential components of small mammal and herpetofaunal habitat.

Table 1. Habitat characteristics that will be measured in this study.

Characteristics	Method of Measurement
Trees: • DBH • Density • Canopy closure	• Diameter tape • Trees/Ha in sampling area • Ocular tube sights / %overstory
Shrubs: • % cover • Species richness	• Ocular tube sights / % overstory
Grass and Forbs: • % cover	• 1m squared quadrats
Forest Floor Features: • Litter layer depth • % cover bare ground • Slash cover • Rock cover • Soil texture	• Core sampler • 1m squared quadrats
Snags: • Density • Decay class • DBH	• Snags/Ha in sampling area • Visual interpretation • Diameter tape
Logs: • Decay class • Diameter • Length	• Visual interpretation • Ave. diam. logs>7.5 cm diam. • Ave. length logs>7.5 cm diam.
Stumps: • Species • Density • Diameter • Decay class	• Ave. # tree stumps>7.5 cm diam. • Ave.diam. tree stumps>7.5 cm diam • Visual interpretation
Stream Characteristics: • Width • Reach type (pool, riffle, glide) • Bank height • Log jam volume • Beaver dam length, numbers (% of stream) • Stream order	
Spatial and Temporal Characteristics: • Slope • Aspect • Elevation • Distance to edge • Distance to road • Stand size/Ha • Time since last harvest • Livestock utilization (low, high)	

DATA ANALYSIS

Objective 1: Describe differences in species composition and relative abundance of small mammals and herpetofauna in oak/shrub and mixed conifer forests across livestock grazing use levels.

Species richness, evenness, diversity, and relative abundance of small mammals and herpetofauna will be compared between each forest type and grazing utilization replicates. The relative abundance of each species will also be compared between the upslope and riparian transects.

The total and average number of captures of small mammals and herpetofauna for each forest type and grazing utilization level will be summarized. Capture rates will be analyzed with the Chi-square statistic. One-way analysis of variance (ANOVA) and the Student-Newman-Kuels (SNK) mean comparison test will also be used to compare capture rates/100 trap nights for each species within the replicates. Abundance of the more common species will be estimated from capture-recapture data using programs CAPTURE or MARK. These estimates and confidence intervals will allow rigorous statistical comparison of abundance among the different study sites.

Objective 2: Identify species with close riparian affiliation or dependency.

The relative abundance of small mammals and amphibians along the stream transects will be compared to upslope areas and summarized in a two-way frequency table. Histograms will be used to compare capture rates along the transriparian gradient for each species. Riparian and upslope comparisons and capture rate along the transriparian transects will be analyzed with the Chi-square test.

Objective 3: Describe specific microhabitat associations of selected species.

Vegetation characteristics will be compared where selected species are caught to areas of no captures using logistic regression. The response variable will be presence or absence of a species of interest and the explanatory variables will be those listed in Table 1. This analysis will allow us to determine which habitat variables are important to the presence or absence of certain species. We will also relate species richness, evenness, and diversity to habitat characteristics (Table 1) at the study site level. Multiple regression will also be used to determine associations between a species' capture rate (relative abundance) and microhabitat components at each of the trapping stations.

JUSTIFICATION

Small mammals and herpetofauna play key roles in ecological function; yet, habitat preferences and responses to ecological disturbances are not fully understood. Riparian areas offer unique resources to a variety of wildlife and their ecological value to most wildlife has been well documented in scientific literature. Nevertheless, small mammal and herpetofauna relationships to riparian areas need further study, as no study exists for the southern Oregon Cascades-Siskiyou region.

Table 2: Study Time Frame

Year	**2003**
June/July	VES and transect surveys for herpetofauna
July/September	Vegetation sampling/data analysis
September/November	Mammal live trapping
October/December	VES and transect surveys (pending funding availability)
Year	**2004**
January/June	Winter and spring term classes/data analysis at Oregon State University
June/July	VES and transect surveys
July/September	Vegetation sampling/data analysis
September/November	Mammal live trapping
October/December	VES and transect surveys (pending funding availability)
Year	**2005**
January/June	Winter and spring term classes/data analysis
June/September	Writing thesis
September/October	Thesis defense

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